RECENT LITERATURE.

HYATT'S GENESIS OF THE TERTIARY SPECIES OF PLANORBIS AT STEINHEIM.[1]—It sometimes occurs to the active student of biology, when wearied with the multiplicity of details, the almost endless species and varieties of the groups he may be making his specialty, to inquire what is the use of this great expenditure of time and mental effort, when the actual result of years of labor and research may be to add but one stone to the foundation of facts underlying the superstructure which others abler than he or his successors, may build up; or if he be synthetic in mental disposition, and capable of adding a well founded, sound generalization as the fruit of the years of his labors as a collector and discoverer of facts, what a slight contribution after all is his new "law" or induction to what is really needed to establish a philosophy of life! The earnest naturalist who desires to make a permanent solid contribution to his science, is animated with the wish to attempt, at least, a solution of two problems: What is life? and second, How did life originate? These problems are or should be the sources of inspiration, the goal to which all his effort tends. The first question may never be solved, though the attempt has been and always will be made; the second may be within the scope of the human intellect, and we may, with some confidence, hope for a solution which will appeal to the understanding of every candid naturalist, and ultimately command the assent of every philosophical mind.

The obvious method of inquiry in the discovery of the laws of evolution is to ascertain the effect upon organisms of nature and life about them, and the mutual relations of the organisms themselves. This is beginning at the bottom of the matter; and the attempts in this direction will in the long run, it seems to us, bring deeper-reaching, truer and more logical results, than by confining the attention alone to the secondary, more superficial study of variations and effects of natural selection. Mr. Darwin has, by his genius, industry and simple, popular mode of presentation of the doctrine of natural selection, produced a revolution in scientific thought. He has sowed the seed and prepared the way for more profound, thorough going views as to the origin of life-forms.

The work of Professor Hyatt before us, as well as his earlier papers on the origin of forms among the Ammonites, which have been noticed in the earlier volumes of this journal, are important contributions to the evolution hypothesis. These essays, together with those of Professor Cope on the origin of genera (1861), and his later papers on the law of acceleration and retardation, with the briefer, more fragmentary writings of other Ameri-

[1] *The Genesis of the Tertiary Species of Planorbis at Steinheim.* By ALPHEUS HYATT. (From the Anniversary Memoirs of the Boston Society of Natural History. Boston, published by the Society, 1880. 4to, pp. 114, with 9 plates.)

can naturalists, have resulted in a distinctive American school of evolutionists, if we may venture so to style it. Cope and Hyatt each working quite independently of the other, and in different branches of the animal kingdom, have arrived at the conclusion that species and genera may be both slowly, and sometimes suddenly produced through the action of the environment upon the animal or plant, producing a tendency to variation, after which the action of the laws of heredity, checked by natural selection, legitimately produced their results.

It is not our present purpose to make an exposition of Cope and Hyatt's views, but referring the reader to their essays and articles, to give in this review the results of Professor Hyatt's studies on the evolution of the Steinheim fossil snail-shells. These Tertiary fresh water shells occur in great abundance and variety of form and individuals in clay pits at Steinheim, near Stuttgartt. The shells lived in a Miocene pond or lake more or less shut in from any other waters. Attention was first called in 1866, in a brief paper by Dr. Hilgendorf, to the shells in these beds, and the light they threw upon the evolution theory, which led Professor Hyatt, in 1872, to collect these shells in large numbers, and to make an independent examination of them. The shells all belong to the genus Planorbis, and the numberless varieties and forms taken from the beds, appear to be lineal descendants of four varieties of a single ancestral species *(Planorbis levis)*, found in the lowermost beds deposited at the bottom of the lake. The inhabitants of these beds were not necessarily evolved through a vast period of time (as in general demanded by Darwinians) but Hyatt states that Professor Cope's researches among fishes and reptiles, his own among Ammonites, and at a later date Mivart's work on the "Genesis of Species," have all given a large amount of evidence, which tends to the conclusion "that vast periods of time are not necessarily essential to the production of new species, or even new generic or family forms."

Hyatt considers that the normal, smooth, primordial form *(Planorbis levis)* lived in neighboring Miocene lakes, and, before its migrations into the Steinheim lake, had four varieties, and subsequently reproduced these or their immediate descendants in the Steinheim lake. Four principal series were developed from these four varieties after their migration into the Steinheim lake, and while the original forms in the first series or line of descent had the closest relationship with each other, their descendants gradually diverged, until finally no hybrids connected the different series with each other. The first series culminated in variously keeled forms, and finally ending in an untwisted corkscrew-like form; the second series preserved the smooth normal form; the third series finally assumed a heavy, somewhat angular and rather large form, while the fourth series terminated in large, heavy, conical forms, the last one having a high spire very unlike

Planorbis and more like a Paludina in its general shape. It should be borne in mind that the forms belonging to the first series were connected by hybrids, and the whole series "presents to the ordinary observer a chaos of similarities and differences."

Referring our readers to the paper itself for details and illustrations, we may, without further delay and without criticising the author's mode of research, except to say that the time and patience spent upon the work, and the author's evident candor and accuracy, lead us to accept his results as sound inductions, now quote the conclusions of this elaborate memoir.

(1) The extraordinary modifications and series of shells found at Steinheim are in one way exceptional, and owe their existence to exceptional conditions.

(2) These conditions appear to be the isolation of the modified descendants of *Planorbis levis*, due to the absence of competing types, and the character of the environment.

(3) This environment was suitable for the propagation and perpetuation of the distinctive peculiarities of their series, and unfavorable in various degrees to those of the sub-series of the first series.

(4) That while the perpetuation and survival of the differential characteristics can be thus accounted for, we must look to other causes for the production of the parallel forms and the regularity of succession of these forms, as shown in the arrangement in the different series, and in the development of the individual.

(5) That this cause lies in some law of growth and heredity which reacts against the tendency of the physical environment to produce variations and differences, and produces parallelism in the development of different individuals of the same species, of different species in the same series, and in the succession of forms in the different series, and also limits the tendency to variation within definite boundaries in the species, especially in *Planorbis levis*.

(6) That while the influence of the environment must be admitted as paramount in exceptional instances, it for the most part produces these exceptions in extreme cases of parasitism, and the Steinheim shells are not parasites, and cannot be assumed to have been under similar influences in respect to the laws governing the size and genesis of the series, they ought, therefore, to come under the same laws as other forms occurring in other localities.

(7) That this appears to be the case except in so far as they are a very limited group, confined to a very limited field, a field free from competition, and extremely favorable to their growth for that and other reasons.

Professor Hyatt next inquires, "what is this law of heredity and growth which maintains the type, causes parallelisms and constrains variation under ordinary conditions, but still, in certain cases, is forced to give way to physical influences.

"Ruling out the lost or transient forms which are not perpetuated, we see that the fundamental law here, as elsewhere, is, that all the characteristics are inherited after they are once introduced.

"In former essays, especially written for this purpose, I have tried to show that there was such a general law which is so plain and simple that I have wondered that no authors have made it the basis of investigation except Professor Cope and myself. In every series of animals which I have studied, the same fact appears, namely, that in a given number of generations, inherited characteristics of every kind tend to appear in the descendants at earlier stages than that at which they first occurred in the ancestral forms. Whether characteristics are normal or abnormal, provided they are fixed in the race either by the action of natural selection or by the direct working of physical causes, they are inherited according to this law.

"The law of acceleration appears to me, at present, to show the manner in which characteristics, which are perpetuated, finally either disappear or become fixed in the young, or even in embryo. This conclusion may be followed out by any one who will arrange a series of animals or their shells, according to their adult affinities and their developmental characteristics. He will then see that adult characteristics which are introduced in ancestral forms, tend to reappear at earlier and earlier stages, as he travels along the series."

MAREY'S ANIMAL MECHANISM.[1]—Although the main principles and facts contained in this interesting volume have been already given to the public by way of abstracts in scientific journals, yet it is not too late to call the attention of zoölogists to the value of this work in their studies. Animal mechanics has been much neglected from the difficulties of the subject. The practical bearings are, however, of great importance, for if we knew under what conditions the maximum of speed, force or labor which man either singly or in armies could furnish, might be obtained, a general would know how much of a load a soldier could carry, while if we knew exactly at what pace an animal does the best work, whether he be required for speed or for drawing loads, we could all be Mr. Bergs and prevent much suffering in our noblest of animals, the horse, and that only less useful creature, the ox; while in the good time coming, when electricity may serve as the motive power instead of steam, animal mechanics will reach its apotheosis in a flying machine adapted to the wants of our everyday life, as well as of the traveler, soldier, and all whose calling may impel them to seek a means of locomotion in rapid aerial transit.

[1] *The International Scientific Series. Vol. xi. Animal Mechanism:* a Treatise on terrestrial and aerial Locomotion. By E. J. MAREY, Professor at the College of France, etc., with 117 illustrations. New York, D. Appleton & Co., 1879. 12mo, pp. 283. $1.75.